ON THE METHOD OF INDUCTION AND ITS RESULTS IN MEDICAL SCIENCE.

A LECTURE,

READ AS

INTRODUCTORY TO THE OPENING

OF THE

MEDICAL CLASSES

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BY

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A LECTURE,

&c. &c.

MEDICINE, the study of which you are about to commence, has always been deemed a liberal pursuit, as affording the amplest range for the exercise of the highest intellectual powers, as well as of the best feelings of our nature.

It has for its object the well-being of man, which daily experience proves may be compromised in a thousand ways; for life is a continual warfare, and the condition of our existence a never-ceasing conflict with elemental agents. It may be compromised by the undue action of those forces which are developed in the individual, or arise out of his social position. It imports the physician, therefore, to be acquainted with the relations of man with nature, with society, and with himself,—to ascertain their respective influences, to trace their actions, and define their laws.

With so extensive a field for intellectual exertion, it is no wonder that medicine should be accounted one of the most difficult of studies—so difficult, that a complete knowledge of it has not only been denied to any individual, but even to the race. The very length of the journey often makes the traveller linger on the road; and, as in order to attain the wished-for goal, he must call to his aid all the appliances and means which will further his progress, and sustain him in it—so the student of nature must bring to his task those habits which, from long experience, are known to invigorate and discipline the mind.

He must be prepared by such preliminary studies as will give pliancy to his faculties—will render the perceptions vivid—the attention alert—the imagination inventive—the memory full—the judgment just—the reason searching.

Preliminary studies, however, such as those of language, the discipline of numbers, and general physics, must not be pursued as ends, but as means. Obtain all the light which you can to illumine the paths on which you are about to enter; but, remember, that there is no portion of natural knowledge which does not reveal its Infinite Source, and which is not too vast for finite comprehension;—that though the various sciences are connected, they are not involved: they touch each other respectively but in one point, and it is these points of contact with medicine which you must ascertain, and learn to avoid a too curious

inquiry into the connexions which they may exhibit with regard to each other.

When thus disciplined you are prepared for observing. But observation is one of the most difficult of processes. In the first place, the facts to be ascertained are often very complex, and those of medicine particularly difficult to unravel. Then, again, our observing faculties are deceitful, and the mind interpolates views which nature never offered; and if, to correct these sources of error, we resort to the experience of others, the appeal may still be made to faculties as deceitful, and judgments not less erroneous than our own.

Neither attention, perseverance, nor a minute spirit of inquiry, nor dexterity—although all are most precious gifts—will produce a rigorous or exact observation. They have all been exerted in the pursuit of the solemn frivolities, as strenuously as of the solid discoveries of science.

What then constitutes the true method of inquiry? This is a question which concerns us all most nearly; and I have in vain sought for a subject more worthy of the student's attention, than the investigation of those laws of observation by means of which alone truth can be attained. That there is a right and a wrong method of observing, is evident, since mankind have always observed, but rarely discovered.

Some have referred to experience as the just method of right observation, understanding by expe-

rience the view of a multitude of facts. As experience, however, does not consist in seeing much, but in seeing well, there must be method, there must be discrimination, and a comprehensive perception in our experience, to make it available and productive. Others have brought forward two modes of looking at nature, each of which has had its advocates—I mean, analysis and synthesis; but the signification attached to these terms, by the mathematician, the chemist, and the metaphysician, are very little accordant. By analysis, the subject is broken into its constituent parts, and its properties determined by the investigation of each; while by synthesis, its nature is supposed to be perceived as a whole, and its qualities and attributes are thence deduced.

Now, although analysis and synthesis are two admirable instruments of investigation, neither the one nor the other will lead to the discovery of truth, unless the method of using them be just. Aristotle and Plato, Descartes and Newton, Stahl and Boerhaave, Cullen and Brown, have each used these intellectual optics, and with results as various as their systems.

Others vaunt experiment as the sure road to discovery. But this also will only lead to truth if the experimental process be correct and comprehensive.

The ancient anatomists experimented, it is said, even on the living human subject; and yet they saw in the arteries only canals for carrying air, in the

brain a pulp for tempering the heat of the lungs. Almost, in our own times, the celebrated Bonnet attributed all cases of softening of the nervous centres to the effusion of a non-entity, which was termed atrabile. Thus, then, it is not sufficient for the investigation of truth that we should look, but that we should perceive. Insight is more requisite than sight. Our purpose or object, and our mode of observing, should be clearly and fully recognised by the mind before we begin to observe, or else we shall inevitably fall into those errors which for so long a period obscured and falsified science.

Our purpose or object in observing is to make use of facts; and we can be said to possess the power of using a fact, only when we know what it is caused by, and what in its turn it will produce. If the fact observed is recognised by the mind as forming a link of a consecutive series, we are said to be in possession of science or scientific knowledge. We can now trace whence it emanates, and what it will produce; we can, in a word, make use of it.

Cuvier's investigation of fossil organic remains, is a splendid and an apt instance. Previous to him, many naturalists and philosophers were aware of the existence of petrified bones imbedded in the crust of the earth, and had indulged in a variety of conjectures to account for their presence. He, however, arranged the hitherto isolated and useless facts into a series, of which he could at any time predicate the antecedents

and consequents. The merest fragment of a *petrifaction* enabled this great man to evoke those ancient shapes, which were hidden amid the ruins of a lost world, and to decypher in its hieroglyphics the history of primeval races and terrible catastrophes, and to extend the sphere of human observation beyond the origin of the human race.

I might shew you, from the consideration of facts, taken in any of the other departments of human knowledge, that science or scientific acquirement exists only when we observe a series of consecutive and connected facts, so that the possession of one of them enables us necessarily to trace the rest. Hence all science pre-supposes a belief in the existence of order in the universe. We walk in the full assurance, that under like circumstances similar effects ensue; that there is an appointed order for all things, above and below us, around us and within us; that the universe is revealed to the reason of man as the work of intelligence only;—a faith as common to the peasant as to the philosopher—to the believer as to the atheist, who, however he may deny an intelligent First Cause, has never been able to shew that the laws of nature are irrational.

Our object and purpose being the collection of consecutive and connected facts, the true method of attaining it may be summed up in the words of that great man, who was the first to point out the right paths to true knowledge:—

"Man," says Lord Bacon, "the servant and interpreter of nature, understands, and can effect just so much as he has actually experienced—more he can neither know, nor achieve." In a word, we must interpret and not conjecture. The mind must resolutely abjure all its darling fancies and its idols, and approach the precincts of the great temple of nature with humility.

In the language of Milton, "It must measure its wisdom by simplicity—its strength by lowliness. It must count its first to be last—something to be nothing—to be of great command in that it is a servant."

The first step towards a right interpretation of nature, is to seize the facts as they arise, without adding to, or diminishing, their import, and without changing their order of sequence.

When the ancient physicians saw that an abscess quickly healed after bursting, and that perspiration succeeded the hot fit of an intermittent, they *conjectured* that all disease was caused by the introduction of humours, which were at first crude, then concocted, and then evacuated. Hence the foundation of the theory of crudity, coction, and crisis; of expectant medicine, and critical days, which Galen strengthened, and which Laennec could not throw aside.

This error of assigning to nature our views and feelings, instead of simply interpreting facts, is so adhesive to the mind, as to deserve at the hands of

Lord Bacon, the quaint but expressive title of "idols of the tribe." In order to avoid it, there are two modes of proceeding, by which we may clear away the mental mist, and hope to view nature with a pure and unmixed light.

By the first, we simply repeat the observation, carefully noting the natural sequences.

By the second, we re-produce the event forcibly by experiment, which is the complement of observation.

We may always observe, but in some portions of human knowledge we may not experiment. In medicine, our knowledge of disease is based on observation; that of its cure, on experiment.

If the repetition of the observation gives the same sequence of events, and this is further confirmed by a forcible reproduction by experiment, we may rest satisfied that this is the order of nature, in which is truth; and at this point we may acquire additional force of conviction by a judicious appeal to the testimony of others. Hence, reading such records as bear on the subject of our search, is essential to the rapid development of science. All the great advances have been made by great men, who had gathered up the knowledge of the past as a foundation for that of the future. The history of every science exhibits so few instances of men anticipating their age; and, on the contrary, such a slow unbroken continuity of progress, that the confident and the sanguine would do well to remember the remark

of the witty Fontenelle, that "only great players have great luck."

I say thus much in favour of the union of a judicious course of reading with observation, because it has of late been the fashion to be too exclusive on this subject.

After a series of facts has been obtained, the second step is to extend it, and the mental instrument by which this is effected is termed analogy. The faculty of finding resemblances in things is doubtless innate. In its application to scientific purposes, however, we are likely to be deceived in two ways, either we shall see fanciful resemblances, or we shall perceive no differences. Of the latter error, I would venture to say that the German school of Natur-Philosophen affords an apt illustration. They have soared so high, and looked down from so lofty a point, that all distinguishing characteristics are lost in the scientific haze. On the other hand, fanciful analogies have always abounded in medicine. Witness the theory of fermentation transferred from chemistry to physiology; witness the Archæus, or corporeal soul, of Stahl and Van Helmont; the humoral pathology of older days; witness, in short, the whole history of medicine, which has ever borrowed the latest discovery of the last science to explain by analogy the mysteries of organisation.

When we have compared analogous series of facts, we shall always find one which is common to the

whole, and this fact so obtained is termed a law. It should be borne in mind, however, that this law is, after all, only a general fact, which throws no light on the essential nature of things. We know the law of gravitation, but nothing of the nature of gravity. The greater the extent of each series of facts, and the greater the number of such analogous series, the more general and solid will be the law which results from their comparison.

It is most difficult to know when we should cease to collect and compare, and begin the more enticing process of generalising facts. The history of science shews that mankind have almost invariably generalised prematurely.

Notwithstanding this warning voice of the past, I am tempted to think that our progress is retarded in several departments of medicine, by want of arrangement. The scientific world has for the last seventy years been employed almost exclusively in amassing particulars, until its state may be compared to that of an army impeded by its baggage.

Every thing is mooted, and nothing is settled. One series of facts is brought forward to prove a certain point, which is oppugned by another series of contrary facts. And this opposition of fact to fact is usually mistaken for victory. It should be remembered, however, that both series may be incomplete; and in the majority of cases, they will actually be found to be so. A vigorous generalisation, if it led to

no other consequences, would at least clear the field of science of much which impedes our advance.*

* The advantages accruing, would be the reduction of a confused heap of particulars into orderly groups;—the danger which might result, would consist in mistaking these partial generalisations for the absolute expression or law of the whole mass of facts. In spite of what is said against hasty generalisations, as they are termed, they are of immense use in advancing science, provided they are limited and recognised as partial. The error is relative, for they are not absolutely false, except only when applied to too extensive a series of phenomena. These partial generalisations will be found to contain and to convey a subordinate truth, linking *many*, instead of *all*, the particular facts, and they greatly facilitate the mind in the contemplation and the reduction of details.

On these grounds, the objections urged by a distinguished authority against the Baconian system as a practicable one, admit of a reply. It has been asserted, that this system is too cumbersome and inapt for discovery, and not the natural mode in which the mind works, in its search after truth, and that Bacon's signal failure, on a trial of his own method, proves these assertions. The mode in which discoveries are made, according to the same authority, is this,—several hypotheses, *relating to the facts requiring interpretation*, are to be successively tried, until the one which fulfils the condition of the problem is found. Now it is quite true, as far as regards any individual discoverer, that this is the mode in which all successful investigations have been made—for few observers have arrived at truth by doing as Bacon recommends, and adhering *formally* to his rules. But it is no less true, that the method advocated is so far from being opposed to the inductive process, that it actually is the inductive process. For the hypotheses alluded to will be found

After a general law is obtained, we are permitted to shorten all the succeeding steps of our investiga-

to be some of those partial generalisations, by induction, made from time to time, and handed down from age to age.

The history of the progressive advancement of science confirms these views—for, in tracing it, we find that the first epoch of scientific discovery is characterised by the collection of a few facts, and many theories. A theory of some kind, as M. le Comte has lately observed, being essential to stimulate the human mind in gathering facts. Various observers arrive at various conclusions, each generally looking on his own generalisation as solely and entirely true. The second epoch consists in the accumulation and comparison of new facts, for the purpose of refuting or substantiating some one of the opinions which have floated down the stream of knowledge, in the course of which conflict one or other of these theories is proved to contain all that is true in the rest; or a new principle is evolved which embodies the others, and explains the whole mass of facts. When the true interpretation of any series of phenomena is at length found, it is again submitted in the third epoch to a fierce and fiery ordeal of doubts and opposition, until the pure ore of truth has lost, in the furnace of human passions, all its dross; and then, and not till then, is it placed among the intellectual treasures which pertain to our race.

So constant and so searching among all nations, and at all times, has been the opposition of mankind to the reception of a new principle, that one is tempted to regard, with Littrow, this most ungrateful fact, as the consequence of a law of the human mind, essential to make truth attainable. Certain it is, that it is well fitted to separate the useful from the useless, and though the individual be sacrificed, the race is benefited.

In the moral, as in the physical, economy of man, the welfare

tion, by neglecting the means hitherto used, of proceeding from particulars to generals, and at once to assume that the new phenomena, presented for interpretation, are under the new law.

If any hitherto unobserved planet or comet should suddenly become visible, the astronomer would at once assume its motions to be regulated according to the laws of gravitation; and the fact of finding them to tally, would test the truth of his assumption.

This mode of investigation, by ascending from individual to general phenomena, is termed the method of induction, which I will now sum up so as to lay it clearly before you.

You collect facts, which relate to the subject to be investigated, and see that they form a natural series. You extend the series by experiment, and by comparing it with other series of analogous facts, you arrive at a fact common to the whole, which is termed a law, but which simply interprets without revealing the nature of the series. Up to this point you have proceeded by analysis, that is, from particular facts to a general conclusion. Instead of pursuing the slow and laborious mode, in the explana-

of the individual, perhaps, is subordinate to that of the species. Like the worker bee, the individual is doomed to go forth and gather, and bring in his store, and labour with a blind love, and die in the discharge of duties which extend far beyond his own sphere, and sustain a polity, the ends and objects of which it is not appointed for him to fathom.

tion of new analogous facts, offered to your observation, you may at once apply to them the general law which you have deduced ; and if it is a general expression of their actions and states, they are said to be explained by it.

This second part of the process is termed synthesis. By analysis we best acquire, and by synthesis we best communicate our knowledge. This method is opposed to the ancient one, which, as it substituted conjecture for induction, was termed the method of anticipation. A cause was always assumed derived from some darling fancy, an idol of the mind, and then adapted to the perceived phenomena.

These are the only two *methods* by which the intellect has ever been known to work — the method of conjecturing causes, or the method of observing laws ; anticipation, or induction ; and, unless the course of nature be changed, the conclusions of the latter must remain as solid as the foundations of the universe.

It is generally believed that Lord Bacon, both by precept and example, has interdicted the search after essential causes, confining the inquirer to the simple observation and comparison of series. I scarcely know how this opinion has gained ground. For his writings are filled with assertions, implying the capacity of the human mind for searching into essential being ; [redacted] a capacity, for example, not only to deduce the laws of life, but for ascertaining in what

life consists. In these hopes the most eminent of his disciples, with intellects which have immeasurably extended the empire of man over the elements, have not dared to follow their great master. For nearly two centuries have they been soliciting nature with all the powers, which native genius and acquired treasures could command; but as yet have not been permitted to penetrate the inner sanctuary, nor obtain the slightest insight into that mysterious union, through which secondary causes spring from the great First Cause.

Of late, it is true, that the audacious longings of the human reason for complete knowledge—"to taste the fruit thereof, and be as gods"—has emboldened two of our neighbouring nations to endeavour to fathom this great mystery; but with so little success, as to serve rather as a warning than an encouragement.

A mind like that of Lord Bacon's—of such a vast comprehension—of so pure an insight—filled with poetry, and drawing its light at once from that etherial fire which burns on the eternal altar—might, in its visions, have hoped to have passed the limits assigned to the rest of his race. But to us the sphere of knowledge is bounded by an unknown world, which meets us on every side, opposing all our attempts, — which, while we know that it must contain the origin of all those powers, whose manifestations are here evidenced, yet are we not permit-

ted to perceive. Its influence is felt, though its rays have not as yet reached us.

Do not you, I intreat, imagine that what I have said does not concern yourselves—that this detail of a method, is a scholastic disquisition, rather than a practicable system—that you may not require it, under any circumstances, or at any time; and certainly not under your present circumstances, and at this time, the spring and onset of your career. If ever it is of advantage to think rightly, it is so at your age, when the mind is fresh and ductile. Postpone this discipline, and time will bring with it changes from which you will not be exempted. It will bring with it rooted prejudices, and modes of seeing things after your own ways; your position in life, and your associations will give a colouring to events; and you will find that you have not escaped the thraldom of habits, but have only acquired inefficient ones;—that your mind has been moulded by circumstances, instead of by principles—that your views of science and scientific advancement are oblique—that your laborious industry is unproductive, because immethodically, or falsely exercised—and that your years have slipped away without enriching the intellectual stores which were entrusted to you.

Remember, that whatever we possess of science has been obtained only under this method—that all that is good in past systems, was unconsciously collected by this process of mind—and that the posses-

sions of the present, and the hopes of the future, are derivable from it alone. These possessions, and these hopes, have descended now to you, and they who have preceded you in their pilgrimage, have set up land-marks on the road-side to guard you from wandering and guide you to truth—fountains of knowledge to refresh the thirsting mind, and resting-places to give it repose. The field in which they laboured is indeed a vast one, and much as they did, more is left for you to achieve. Let us, for a moment, take a rapid survey of our possessions.

And, first, our profession demands for its base and ground-work, the study of vital phenomena. Life teems around, and above, and below us, in such profusion as to confound the imagination with the incessant action of succession and decay. At no single instant are the materials of the living body the same —particles are attracted and retained—expelled and renewed from the first moment to the last of each individual's existence; and what appears the repose of death, is, in physiology, but another change into other forms of life.

Incessant as is this movement, the composition and direction of the material of this vortex remains the same in each animal; and before the present matter of our bodies shall have passed away, it will have constrained, by virtue of a force residing in it, the newly-acquired matter to move in the same sense as itself. In organisation, therefore, matter must be

considered as the fugitive, and form, or the plan of the edifice, the permanent element.

This appearance of the persistent and stable, amid the variable and transient, seems to be put forth with great emphasis by nature, as the characteristic of the vital force. The elemental agents of even the greatest power are, nevertheless, devoid of form. In inorganic bodies, as in minerals, form is but accessory and dependant on that of the primary molecule. It is in living bodies alone that it appears perfect and individual, and so little changeable, that the minutest colouring on the wing of an insect, seen and described by Aristotle, is recognisable in any living specimen of the species, by the naturalists of our own day.

Not only are organic forms permanent, but they are few. The greatest comparative anatomist of this or any age, Cuvier, has, by a strict generalisation, conducted on the principles which I have here discussed, reduced the myriads of animated forms to four; and it is at this instant mooted, whether even these may not be considered as variations of one plan, and the living universe be but the varied manifestation of one stupendous truth.

Three series of facts have been collected, compared, and generalised; and it is from these data that the laws of formation are deduced.

First, the forms of all animals have been compared with each other; secondly, with the forms

which each animal assumes in its progressive development; and, lastly, with defective forms, or monstrosities.

The comparative anatomist finds, that in the production of forms nature proceeds from simple to complex—the lowest animals are the simplest; and he remarks, that, in building up the animal series, the mould or form is not changed, but only modified, to produce the various kinds of animals; so that, with a very few laws of relation, he can connect and explain the immense range of living beings.

In tracing the development of form in the individual, from its embryotic to its mature state, it is remarked, that the young of every species of animal undergoes a series of metamorphoses in the order of simple into complex. This analogy between the development of the whole series of animals, with that of each individual, suggested a more minute comparison, when it was ascertained that the embryo of each class ran rapidly through the essential forms (not shapes), of those of a simpler construction than itself, previous to reaching its own place in the animate scale; and thus man, who begins his existence with the organless simplicity of structure of the polyp, and rapidly expands to his own sphere, is said, in the extravagant and tasteless language of Meckel and Serres, to be a transient compendium of comparative anatomy.

The study of defective forms proved the truth of

these conclusions. The monstrosities of the human species admit of classification, and form a series, ascending from the simple structure of the lower animals to the complex one of its own species. Each monstrosity offers two points of view. In the one it will be found to resemble the regular structure of the embryo, arrested at some early period of its regular development; in the other, its form, or the plan of its organic arrangement, will be similar to that of some of the classes of the animate series.

These conclusions, which rest on and explain what is termed the theory of the unity of composition, belong to the highest speculations of anatomy and physiology, and have engaged the attention of the greatest intellects at all times, though they have been matured only in our own.

The appearance of an unchanging permanent element, amid the variableness of organic matter, was recognised by Plato, under the term "idea;" by Liebnitz, under that of "monad;" by Buffon, as "moule organique;" by the Germans, as "noumenon," "type;" by Cuvier, as "form;" and not to mention the terms applied by the ancient naturalists to this same notion, under the expressions of "formative,—sensitive,—and rational soul," you remark, that the profoundest thinkers of all times have always separated the idea of life from that of matter.

As to the forms or plans of organs, the laws which apply to the whole organism are deducible

by the same steps, from a consideration of each organ. Hence it is, that comparative anatomy sheds such a light on human anatomy. Each organ passes from a simple to a complex structure in the embryo, and each transient form that it assumes in its development, will be found, fixed as the permanent structure of some of the lower animals. Comparative anatomy shews the human structure, in its most naked and simplest forms; it unravels and exposes the intricate web of the most complex organs. The conglomerated liver is unfolded into biliary ducts; the four-chambered heart may be seen as a simple tube in some animals, in others with two, in a third with three cavities. Our composite lung of tubes and cells, is separated; and the breathing apparatus of one class of animals are tubes alone, and of another gigantic cells.

As an instance of fanciful analogy, let me mention, that as the organs of animals are often only fragments of the similar human organ, so, some of the most eminent German naturalists have regarded the various classes of animals as so many individualised portions of our frame. Thus the class of birds, in which the very bones are subservient to respiration, they call thoracic animals; the mollusca, are walking stomachs, abdominal animals, and so on.

Our profession requires, not only that we should take a general view of the phenomena of life, as exhibited in the animate scale, but that we should

especially understand those which are visible in man; and here we have three objects of study, each a separate science.

We observe, as I have already remarked, that our organism has the property of attracting, repelling, and retaining matter with which it is in contact. The living body, therefore, may be regarded as a great laboratory, in which the most delicate chemical processes are going on.

It is the province of the chemist to investigate, and, if possible, to render an account of animal substance, and deduce the general laws which explain the molecular action of each organism.

We remark, secondly, that there are specific apparatus for receiving and modifying the various kinds of matter which surround us. It is the province of the special anatomist to describe each of these.

Thirdly, the physiologist should examine the forces, by virtue of which the living organism acts on the media in which it is placed.

The first of these, or animal chemistry, yields to no subject in interest or importance. But the investigation is surrounded with such difficulties; the object to be analysed is so delicate, and yet so complex; the instruments which the chemist can command, are so little under his control, and so thoroughly the slaves of the power he would surprise —that we ought to wonder, rather at what has been done, than at what has been left undone in this

science. All we know of nutrition and secretion, is little more than that each organ imitates the whole organism, attracting and rejecting what it is essential it should appropriate or repel; but the laws of organic combination and repulsion are utterly unknown.

In the separation of one constituent portion of organic matter from another, the chemist, however, has been much more successful than in the investigation of the laws of organic chemistry. He has enabled us to perceive that the same wonderful economy is exhibited in the minute and hidden processes of life, as in its large and open display; and that the immense diversity of composition results from a modification of two or three substances, just as the variety of forms were derived from two or three plans.

In addition to these points, we are indebted to the chemist almost wholly for our curative agents. If the profoundest phenomena of life are explicable, I believe that he who unites the study of the chemistry of organic bodies with comparative anatomy, will be the most likely to enlarge our knowledge; and it is in that direction I look for the future advance of physiology.

Of the second of these sciences, special anatomy, a long series of facts, collected from the earliest periods, have made us acquainted with the channels through which the various kinds of matter are assimilated to the frame.

The first channels, or primæ viæ, were described by the ancients. The second, or absorbents, were discovered by Pecquet and Ruysch. The conveyance of the nutritive matter, in a more elaborate form, into every part of the frame, through the third channel, was made known to us by Harvey.

The description of organs subservient to those of individual preservation, we owe to inquirers of all nations, among whom our own has furnished not a few illustrious names. Bichat was the first to compare the parts of the human body with each other, and to demonstrate that a few primary tissues, slightly varied, make up the diversities of our organization. Finally, the various organs have been compared, in the whole range of animals, by Cuvier, who, attending especially to the modifications of the organs of respiration and circulation, has been enabled to assign to each living creature his place in the animate scale.

With regard to physiology, or a just theory of organic forces, we know a great deal most imperfectly. A vast number of facts has been collected, but there is no continuity in the linking. The study of physiology has been pursued with a view to the differences, rather than to the analogies of organs, and each function has been investigated for itself; while its connexion with others has been neglected, or only slightly touched. Not only is the mutual influence of different functions imperfectly known, but

we are ignorant of the whole steps of any one function; and yet practical medicine, in which we have so often to consider the action of one organ on another, will never be a science until the mystery is unveiled. It is fortunate, however, that medicine makes no exception to the general truth, that there is light enough here to guide our actions, though insufficient to enlighten our reason, and that an experience often repeated, and accumulated from age to age, enables the physician to arrest disease, the latent process of the formation of which he cannot always develope.

Besides the movements which the chemist has to explain, the physiologist observes an activity in most of the animal tissues, which not being traceable to any mechanical or chemical agent, he assumes as an ultimate fact, under the name of irritability.

An apparently different kind of force from the last, is found inhering in certain portions of animal matter termed "nervous," which matter, though homogeneous throughout the frame, has the marvellous property of being affected in the most diverse ways by the external world, and awakening in the mind the most varied sensations and emotions.

Both irritability and sensibility appear to admit of gradation, increase, and extinction; both are inexplicable in our present state of knowledge, though it is not improbable that both are functions of nervous matter alone, and not of fibrous substance, as Haller supposed the one to be.

In addition to these two forces, which place man

in connexion with the material world, a third is superadded, *the reason*—which, if we consider it as only an additional bond, tying us to earth, exhibits an instance of prodigal waste of power, without parallel in the rest of the economy of the universe. For all the purposes of this life only, instinct would have been a surer guide. On physiological grounds alone, did others fail us, we may infer that our moral force has reference to other relations than those of the material world, of which it is indeed the great antagonist. The facts I have enumerated, are the results of its power; and the history of science, a record of its conquests. It alone has enabled man to subdue element after element, to become the ministers of his good or evil will. By its means he has reaped where nature never sowed, and gathered where she had never planted. The desert it has rendered fertile, and into a paradise it has brought the desolation of the grave. It has changed the face of the earth, and scrutinised the heavens, and has found both too narrow for its vast wants and restless activities; so that they who have possessed this force in greatest power, have, in all ages and countries felt and proclaimed that its complete fruition and repose must be sought beyond the limits of the material universe.

The study of these three special sciences lays the ground-work of practical medicine. As yet we have no law, which will explain all the phenomena of disease; and the signal failure of those who have

attempted systematic explanation, has determined modern physicians to confine themselves to the accurate description of the internal and external characters of disease in each organ. They are collecting series of facts, as to the suffering of each part of the body separately considered; and it will be long before these several series will admit of comparison, so as to furnish a law by which disease in general will be explicable.

Our age is employed in the study of what Lord Bacon called "the latent processes of phenomena;" that is, the discovery of all which happens between any two remote links of a series, both of which are known to us.

As a familiar illustration, I would say, that an exact knowledge of all that occurs between the application of a match to gunpowder, and the explosion, is an instance of a latent process understood. Now, with regard to all the diseases of the chest, the latent steps by which death is brought about, have been discovered in our time. The latent processes of disease in other organs are being investigated with such success, that medicine has advanced more in the last forty years than it did in the eighteen hundred previous. If you would take advantage of your times, you must work in this spirit; and neglecting systematic views, which will inevitably fail, you must scrutinise single portions of disease.

You must not write systems but monographs, and

be content to know that you too have added something to the material, which some future architect, in a happier age, will use to raise a goodly edifice.

The great advance in practical medicine, is owing mainly to the encouragement given to the study of morbid anatomy. The prescient mind of Lord Bacon marked this among his desiderata. In our times this study has been conducted under two views.

In the first, the morbid structures are considered purely anatomically, and are classed like any other subject of natural history. This has been done by Andral, Meckel, and nearly all the Germans.

Under the second, diseased structure is always considered with relation to the symptoms which mark its formation. Portal, Baillie, and Cruvelhier, have given their authority to this as the best mode of viewing this important subject. Both have their advantages, and perhaps the student should look on morbid anatomy from both points.

If he looks at morbid structure, with the eye of an anatomist merely, the study will have infinite charms for him. It is, in the first place, more regular and uninterruptedly progressive. Then it illustrates the great laws of the vital force which are deduced from a consideration of healthy structure in the animal range. The mind is pleased to find order in disorder.

The works of the German and the French schools, of Meckel, Andral, and Serres, tend to prove that

morbid productions are repetitions of normal structure, having the same ratio to the latter, that defective forms have to symmetrical organs. That healthy tissues degenerate by disease into the early structure of the embryo, or the regular structure of some of the lower animals. In a word, diseased formations are reducible to those laws—few, simple, and grand, which regulate all vital phenomena.

If, on the other hand, the student shall consider diseased structure with relation to symptoms, the pursuit is full of difficulties and repetitions; and its reward will not be in the study itself, but the end—that it will make him a practical physician. In prosecuting the study with this view, he will find the same morbid production marked by symptoms, varying according to the organ in which it is seated. Here the internal characteristics are subservient to the external signs of disease; while in the naturalistic view of morbid anatomy, there is a systematic roundness, if I may be allowed the expression, of knowledge, which warps the mind from practical views, and is injurious to the advancement of practical medicine.

It is from the advocates of this school that we hear, that morbid anatomy is the foundation of medicine—it is, however, only one of its chief pillars. The object of the physician is not only to ascertain the ravages of death, but to prevent them; and this can only be done by marking the external signs of

the nascent hidden mischief, and by knowing the effects of remedies.

Logically speaking, that cannot be called the foundation of any thing on which the whole of its parts do not rest. Now medicine is neither based on a knowledge of symptoms alone, nor on that of morbid anatomy, nor on that of remedies. For an acquaintance, however complete, with any one of these, will not lead, as experience proves, to that of the others. But the true basis of medicine, on which all its parts repose, and from which they may be deduced, is a knowledge of *disordered functions*. Symptoms express their external signs, morbid anatomy their tendencies and results, and remedies become the excitants of function counteracting these tendencies, or removing these results, or obliterating these signs. The student is apt to believe that remedial agents act by infusing new powers into the frame; they simply modify and call forth, without adding a tittle to the functions of the body; so that it is neither the physician who plans, nor the remedy which *excites*, that are the proximate instruments of cure. The functions of the body alone effect this, allaying the tumult they had themselves raised.

When medicine has been based on a knowledge of symptoms chiefly, it has led to all the errors of the nosologists; when on that of morbid anatomy principally, it has paralysed practice, and the mind, despairing of opposing the ravages of disease, has, as in

France and Germany, been content to suggest ptisannes, and to look on. When the knowledge of remedies has been made the great foundation of physic, the result has been the grossest empiricism, with all its uncertainties and boldness: and this feature has, till within the last few years, been the characteristic of English medicine, which exhibits more instances of violent transitions in its practice than any other.

In the present imperfect state of medical knowledge—in the absence of those leading ideas of disease, from which its whole nature will one day be strictly deduced—the physician is compelled to search into four series of experiments and observations, in order to eke out his knowledge, and to fit himself for practice.

I. He must know the action of remote causes; such as that of elemental agents—food, emotion, &c. —on the frame.

II. He must know the value and signification of external signs, or symptoms; as indicating disordered function.

III. He must know the nature and tendency of disordered functions, in producing disordered structure; that is, morbid anatomy.

IV. He must, lastly, know how the individual is affected by remedies.

The knowledge of remote causes, shews the circumstances under which the disease has arisen, and

points to its probable nature; that of symptoms, ascertains its seat; morbid anatomy, exhibits its tendencies; and the action of remedies keenly watched, declares the capacities of the constitution, and measures its powers of strength or feebleness.

Whenever any one of these sources has been neglected, and the others unduly appreciated, practical medicine has been retarded. Thus, from the time of Sauvages to Mason Good, the era of nosology, medicine was made to rest on a knowledge of the external characters of disease chiefly; and the result was, that the curative indications were grounded on hypothesis, instead of a knowledge of disordered functions, well ascertained. Thus a set of symptoms were grouped under the term putrid fever; the abstraction putridity was speedily converted into a reality; the labouring organs were overlooked; and antiseptics prescribed to subdue the hypothetic putrid element.

The undue appreciation of morbid anatomy, at the expense of remedies and symptoms, in Germany especially, and in France partially, has raised up in our day a sect, who declare each symptom to be a separate malady, and each particle of a drug a powerful agent. It would be no difficult task to trace the origin of this, and all other systems so arising, to the temper and mental habits of the age and country in which they spring:—they express, in exaggerated terms, its wants and deficiencies.

And now I have fulfilled the object which I had in view, in unfolding that method, and some of its results in medicine, which has given such an impulse to every other department of science: and the survey to myself has not been without its lesson. It has shown me how painfully slow is the advance of human knowledge, and how vast the distance between our hopes and our possessions: and as I endeavoured to track the workings of master-minds, I observed that each felt the insignificance of man amid the might of nature; and that he who looked most loftily, tempered his gaze with such humility, as to see nothing in his magnificent acquisitions but a few shells gathered on the shores of an unknown ocean. And this estimate of human powers, I thought, should be a bar against the indulgence of all those envyings and heart-burnings that too often embitter the professional career.

And, then, if I followed them into the recesses of their study, I learnt that knowledge not only fills but purifies the understanding—that, in their communing with nature, their minds had insensibly imbibed her influences—that their industry, like hers, was calm, unobtrusive and incessant—an instinct rather than an effort, and its reward the gratitude of mankind. If their lives were chequered with the good and evil of our lot, I saw that they sustained the trials of prosperity with honour, and the sharp strokes of adversity with dignity. The conscious-

ness of duties discharged, and the occupations of their career alleviated private griefs; while the contemplation of the serenity and steadfastness of nature prepared the heart for those higher and holier thoughts, without which there is indeed no repose.

THE END.

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